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FIRE RESISTANT WALLBOARD

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The present invention relates to an improved fire resistant gypsum wallboard.

As is well known in the building industry, fire resistant wallboards are commonly used for the purpose of retarding the passage of fire. Of the various fire resistant boards utilized in the past, one type consisted of the dihydrate of gypsum, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, having unexpanded vermiculite flakes dispersed therein, such as disclosed in Patent No. 2,142,164. The general theory behind this type of board is that the board tends to retard the passage of flame and intense heat because the dihydrate of gypsum, when subjected to intense heat, gives off its water of crystallization, and in so doing keeps the area on the side of the wall away from the flame relatively cool. Essentially the gypsum is calcined during the foregoing process and it tends to shrink. While the gypsum tends to shrink, the dispersed vermiculite flakes expand to compensate for the contraction of the gypsum thereby tending to prevent the board from pulling away from its points of anchorage as a result of such shrinkage. One of the shortcomings of boards containing gypsum and vermiculite flakes was that fissures were produced by the expansion of the vermiculite and such fissures enhanced the passage of flame and heat through the board. It is with an improved fire resistant board which overcomes the foregoing shortcoming that the present invention is concerned.

It is the primary object of the present invention to provide an improved fire resistant gypsum wallboard which has greatly improved fire resistance than previously known types incorporating gypsum and a material such as unexpanded vermiculite for compensating for the shrinkage of the gypsum.

Another object of the present invention is to provide an improved fire resistant gypsum wallboard containing a plurality of additives to the gypsum, said additives functioning under heat to complement the action of each other to thus provide a fire resistant wallboard capable of providing greatly improved fire retarding characteristics.

A further object of the present invention is to provide a highly effective fire resistant wallboard which may be fabricated at a relatively low cost. Other objects and attendant advantages of the present invention will readily be perceived hereafter.

The improved fire resistant gypsum wallboard of the present invention consists essentially of gypsum having dispersed therein both unexpanded vermiculite flakes and unexpanded perlite granules. When this board is subjected to intense heat or a flame, the gypsum will shrink. However, the vermiculite flakes dispersed within the gypsum plaster will expand, in their conventional manner, to thereby tend to compensate for the contraction of the gypsum, and in so doing will create fissures in the gypsum matrix. The vermiculite, in expanding in response to being heated, acts in the nature of a starter, by causing fissures, to permit the heat to be directed at the unexpanded perlite which is also dispersed in the gypsum matrix. It is believed that the perlite by being exposed to heat through the fissures created by the expansion of said vermiculite,

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in turn expands to tend to fill these fissures, and by thus expanding, the perlite tends to block the fissures and in this sense cooperates in the fire retarding action by preventing the flame and heat from passing through the board.

The vermiculite and perlite acting in concert thus essentially provide a two-stage action which causes each of them to complement the action of the other. In this respect the vermiculite will expand as a result of initially being subjected to the heat, and in turn will compensate for the shrinkage of the gypsum plaster, but in so doing will create the above described fissures. Once the fissures have been produced in the wallboard by the expansion of the vermiculite, the perlite will be caused to come into action. The fissures not only remove the restraint on the perlite which was previously provided by the gypsum matrix, but also permit the heat to be directed at the unexpanded perlite adjacent the heated fissures to thereby cause the perlite which has a higher expansion temperature than the vermiculite, to expand. As a result of being exposed to greater heat after said fissures have been opened, the expanded perlite tends to fill said fissures in the above described manner and produce the above described result of tending to block the passage of flame and intense heat through the board.

It has been found that the use of perlite without the accompaniment of the vermiculite, which provides the initial fissuring in the board, does not provide the improved fire retarding characteristics because without such initial rupture, the perlite in the body of the matrix will not expand because of not being properly exposed to the heat, and its expansion will be confined only to an area along the surface exposed to heat and not homogeneously throughout the gypsum matrix.

Commercial compositions of the improved fire resistant gypsum wallboard made in accordance with the present invention are as follows:

COMPOSITION

Material	Pounds per 1,000 Sq. Ft.	
	1/2" Board	5/8" Board
Paper Pulp.....	4.5 (24%)	5.0 (21%)
Glass Fiber.....	8.5-9.0 (45-47%)	11.5-12 (49-51%)
Perlite Ore.....	56-58 (2.9-3.0%)	70-72 (3.0-3.1%)
Vermiculite Ore.....	40-42 (2.1-2.2%)	50-52 (2.1-2.2%)
Paper Covering.....	140	190
Core Starch.....	10.8-13.5 (57-71%)	13.6-17.0 (58-72%)
Stucco, by difference to make.	2,050 (93.2%)	2,550 (94%)

Approximately 77-87 pounds of water are mixed with the above ingredients per hundred pounds of stucco, depending on the amount required to obtain proper fluidity of the mix.

The foregoing percentages are based on the total weight of the core exclusive of the paper covering. Where ranges of ingredients are given in the above table, such ranges merely set forth manufacturing tolerances which are observed in a continuous formulating process and these ranges are not intended to reflect critical ranges of materials.

The paper pulp is used to provide weight and water control. In this respect the paper pulp soaks up water and when the water is driven off during drying causes minute air spaces to remain in the board, thereby controlling its weight. Furthermore, the paper pulp increases the flexibility of the board. The glass fibers provide bonding strength for increasing the strength of the board by providing a fibrous network across the fissures produced